

Andy Urich: While we're switching computers I'll briefly give an introduction. So I'm going, Frank asked me to talk about preexisting digital tools that can be used to analyze the visual content of moving images. But I'm not a computer programmer. I'm a film historian and an archivist. So I'm trying to look at these tools to see what possibilities they might offer us in those worlds. And so if people who have the skills and can describe these tools please jump in.

The other point, sort of getting back to Brian's [Graney] opening remarks about the relevance to the themes discussed yesterday in terms of loss, in terms of representation, in terms of materiality, the question is whether these tools address those issues or not. In sort of looking back over them after yesterday's discussion they don't seem to immediately address those issues but maybe they do in some ways maybe these tools can be adapted to address what we were talking about yesterday.

Another reason I'm looking at this is I don't know how many of you know Indiana University, maybe many of you do, is going to start digitizing, mass digitizing all of, well not all but most of the audio visual archive material on campus. So we're talking hundreds of thousands, maybe even a couple million, film, video, and audiocassettes. So one thing I'm thinking about in terms of the film archive is that if we digitized 69,000 hours of film how can we look through all of that. So these are automated tools. We're going to have 69,000 hours of digitized material and no one is going to be able to sit through and look at all that. So if we have these automatic tools that will allow us to maybe find the best print of a copy or find where errors might be involved. That would be very helpful for us at the film archive here.

So I'm looking at a couple of tools that will just be a survey and we can sort of discuss how they might be useful for research. From looking at these tools immediately they seem really connected to fields in film studies more concerned with the formal analysis with empirical research. I'm thinking of work by people like, two have done work in average shot length, like Yuri Tsivian or the classical Hollywood cinema study by Cornell Thompson and Staiger, people who do cognitive film studies, that kind of analysis. It seems to be directly related to that kind of stuff maybe more than historical research. I'll skip that.

Before we start talking about more complicated digital tools I think it's important to be aware of the basics. Film scholars are still sort of behind, I think, somewhat in using tools even just like ripping DVD's, editing, and stuff like that. For filmmakers it might seem pretty basic but I think you can use it to then compare different shots between different versions of films. You can just do it in Final Cut Pro and then it has the advantage of something you can just sort of post-up online and a lot of people can watch it. It's oftentimes in conjunction with, I have the sound turned down but this is looking two different versions of the Hitchcock film, the sound version and the silent version. So if you have an article about this and then you wanted to make this video it's really easy to do by ripping a DVD, like I said, Final Cut Pro.

So I think some film scholars, Captain Grams with the University of Sussex is sort of advocating this kind of thing. But I think it really does allow media scholars to sort of

make a digital component to their written arguments. I think this is a pretty good example. This gentlemen took “The Sunbeam,” a Griffith film, linear plot and then realized that it takes place in these five different scenes in a hotel. He placed the scenes where they take place in the hotel. So this is the top left, that’s the downstairs and there will be the upstairs right there. You can see people moving back and forth between the rooms. So this is just using Final Cut Pro. It’s not using something too complicated. It wouldn’t work for every kind of film. It really worked for Griffith because his shots really sort of were framed by the room so you can really recreate the space in this way. So these are just really simple tools that we could start using without the help of an IT department or computer programmers.

The other tool that’s sort of off the shelf is called Popcorn Maker from Mozilla. This video that’s embedded, so it finds the access code of videos on YouTube, Vimeo for the internet archive. This video right here is a home movie that a friend of ours found. It’s an orphan home movie from Lansing. We put it up on the internet archive. Someone who is in Lansing downloaded it, edited the two home movies into six minutes, put it up on YouTube. It got like all of these hits and people were saying “Oh, I lived at that corner.” It’s showing all the houses and they could figure out what year it was. We had no information about it. So then I went through looking at the comments from people and then it says it starts out at the corner of whatever the two streets in Lansing are, Kalamazoo and something like that. Then I went through the entire film and you can embed Google Maps, you can embed text. So then now when you watch it, it will tell you exactly where it goes. It’s a car driving through Lansing. And then when you, I won’t show it in the interest of time but you can click on it and it will take the video that’s from YouTube, it will take the Google Maps, it will take your text, and sort of recreate it all live. The advantage of using, and I could have done that in Final Cut Pro with all the information but the advantage of using Popcorn Maker is then you can look at the code and then it will have the start and end time and then it will have the location. So theoretically if you had someone who was smarter than me they could remap it all. You could have a grad student look at a whole bunch of home movies and map it and they could look at them all and they could bring it all together.

So those are sort of simple off the shelf kind of tools. I know we’ll be talking about more agile forms of annotation later today.

So moving from that to more sort of digital humanities tools this is Cinemetrics. It’s Cinemetrics.lb started by Yuri Tsivian, who is a professor at the University of Chicago, who many of you might know. It’s an NEH funded grant that just ended, a three-year grant project. It’s based on earlier work in cinema studies that would study the average shot length so people would time every time there was an edit and then that would allow you to look at the changes in editing styles over time across national cinemas, that kind of stuff.

This is the basic interface. You sit down, you put the movie on the DVD and every time there’s a shot change you click if it’s a close up or a medium shot and then it records it all. I’ll show you what it looks like. That was the original one. There’s a newer one where you actually rip the DVD or you take the video file. It embeds it up there and then you

mark the shot changes and you can get it down to the frame. So this allows for a much more precise version of the shot counting. The problem with that then is now they record at different qualities/information. So the older method is not so precise. This is more precise and they're finding out that they have to sort of manage their data. So they're finding if you've done it the old way you might not have found as many shots as if you do it this way, which I think is a problem with any sort of open source collaborative project that's bringing a lot of different information from different people.

So you do that. You go through, you mark every shot. It ends up with these diagrams where this is the film throughout the, this is the length of the film, this is the link to the shot in seconds and it's top down. So the longer the white line the longer the shot. So that allows you to sort of visualize the sort of editing rhythms of the film. Not just the sort of average shot length but you can look through at the other information. They've recorded median. You can figure out the sort of rhythms that sort of go up throughout the film in terms of measuring the standard deviation. You can get a red line there that sort of averages everything out. You can see the sort of trend line for the films. Then what it allows you to do is you do that for one film and then you can start comparing different films. Sorry, this was "The Domino" by Tony Scott, 2005. He's known for his quick edits. Then you can compare it with the film from 1940, "Die Letzte Runde" and you can see that the shot lengths are much longer. So it allows you for that sort of comparison from the film. The advantage of these visualizations is it abstracts. You could probably get that if you watched it you could say, hey, the shots are a lot longer but this very quickly based on the labor of somebody else who sat down and did all this you can actually look at it.

Allyson Nadia Field: Which makes it official.

Andy Urich: It makes it quick and official, right. And then what they've done, this is kind of hard to see. So at this point they about 13,000 films that people have; TV shows that people have sat down and figured out every single shot change. Then it gets this scatter plot so you can see this is 1900 to 2010. These little gray dots that are hard to see are all the films that have been documented. This is the shot length. Then what you can do with this sort of, it's like an arm of the Milky Way, is you can put in a bunch of films. So if you wanted to look at every film by filmmaker or national cinemas and then these yellow dots are the films that you've entered and you can sort of see across sort of wide swatches of history and films.

I was mentioning the problems with the data quality. The other problem is there's not any sort of, I mean this is just all kinds of films. So it's silent cinema, it's TV shows, there's a whole bunch of Star Trek. There are a whole bunch of music videos. So it's looking at a very wide range of data. So looking at this 13,000 moving images at once doesn't really tell you a lot.

Matthew Bernstein: Andy, is there a way to segregate out the TV, Star Trek?

Andy Urich: There's not yet and they're realizing that now that they need to start allowing for that kind of separating out. Also, they didn't have the interface when you

put the information in you just put the title and you link it to IMBD and that populates the metadata. So the problem with that then is versioning. Is it the TV version or the film print and which edition is it, that kind of stuff. So they're realizing they need to address those issues to allow for more agile sort of studies. But at the same time, people are spending their time entering this information and it's becoming a pretty great resource. So that's the value, I think, of Cinemetrics.

The next project we'll be looking at is something that's called digital formalism. It was a collaboration between the Vienna University, Austrian Film Museum, and the Vienna Institute of Technology. The Austrian Film museum digitized, they scanned the films. It was a bunch of films by Dziga Vertov. This is the webpage. I'm only bringing this up to show you the importance of digital preservation, that's a whole other topic, but also to think about any tools that do get developed, the issue of sustainability should be thought about from I think the beginning. How accessible are you going to make it, how long are you going to maintain it.

So basically what they did with this digital formalism project is they looked at the, they basically tried to figure out what they can figure out by scanning the films of Dziga Vertov, the Soviet filmmaker. One thing that they discovered is looking at archival film required new tools for image analysis. The ones that were preexisting were based on new TV shows, new Hollywood films. The computer scientists that write these articles always call high quality images. These archival images are low quality which kind of made me upset as a historian but they're talking about a different kind of value scheme there.

So what they discovered is the tools that were existing would find these artifacts of decay, emulsion, scraping off, splices that would confuse the preexisting tools for image analysis. So they had to use what they called robust approaches which instead of just using one technology they would use four or more at once and they synthesize that. And then what that allowed them to do is find the shot changes automatically. So instead of having some grad student having to go through and sit through with Cinemetrics they can find the shot change. Hard cuts are easy to find. They have a problem with a gradual shot changes, so fades, dissolves. So especially something like Dziga Vertov it's a great test case for this technology because he would have a fade and a dissolve at the same time. So they had to, once again, had to come up with sort of very specific tools for dealing with archival films.

Beyond that they're able to sort of find these sort of recurring visual compositions. So they're looking for all of the shots in the film that look like a line, light part and dark part. It comes up with these different sort of mountains or another sort of shape. They'll find every shot in the film that looks like this basic image.

What they found was there's a distinction between film, they had film scholars and a computer scientist analyze this data. They found that there is a really big distinction between what film scholars were looking for. Film scholars looking for semantic information, so not just light dark and this is light dark but what's in it, what does it

mean. So you could see this is a mountain but no people. So maybe if you were looking for one with people that wouldn't necessarily be what the film scholar was looking for.

I want to read this quote because I think it speaks a lot. One of the film scholars in seeing this and in seeing all of the sort of returns that this program brought back in terms of visual similarities, this is a quote. "The computer says more than the man." So I think that gets to, in some ways, the issues that Jackie [Jacqueline Stewart] was bringing up how can we use this technology to be aware of the issues of feminist techniques and approaches to looking at these tools, has kind of a gendered component to it.

So once you get this you get these responses based on basic visual images. They can use it to find where if there's a shot that's been edited throughout a film they can find all the different places that it appears later in the movie. So that allows them to take all of the shots that were from the same camera roll and spread out throughout the movie. What that also allows them to do is then compare different versions so they could find out maybe some shots are in one version and not the other. They can find out if another filmmaker might have reused images from this film. They can compare that and find every time they reused the original film. Also, they can find out stuff that may be missing. So if it shows a motion and there's sort of a shot that's in between that motion that's not anywhere they can sort of extrapolate what might have been originally in the camera roll that's not in the final film.

Shola Lynch: As a filmmaker I feel very naked. This is not what you're supposed to be able to do. Where's the magic? I just want to know. You're making me uncomfortable. I just needed to say that.

Andy Urich: That's one of the, I think, of the advantages if not finding out your secrets but it's sort of de-familiarizing these films that we're totally used to. So something like this Dziga Vertov, "Man with a Movie Camera."

Shola Lynch: Yes, but there are repercussions. For instance, when reviewers start to use these kinds of things you're going to have this kind of really hyper analysis of films that is unfair to filmmakers and really does kind of, there are repercussions.

Andy Urich: I agree.

Shola Lynch: So its not just for you all. It will start to become popular.

Andy Urich: That's, I think, one of the points in raising these issues in relation to the discussions yesterday which is these examples are like scientists working with film scholars. What can we find out? What can we use computers to do? We don't know yet. It's still experimental. How does using archival film ask different questions than using new, modern HD sort of stuff?

Now, these issues that you're bringing up are not addressed in these kinds of studies because it's more experimental. That's why I think it's important to show what can be

done and then we can discuss how it should be done. So that's an important point, I think, definitely.

Jacqueline Stewart: In terms of this digital formalism do you have to sort of set up the codes of all the things you want it to do or will it automatically sort of spew these distinctions out?

Andy Uhrich: I think that's where my knowledge is, that's beyond my knowledge. So I think what they're doing is they're just trying to figure out what can they use this technology to do. Ideally, and I think if you were to sort of use these it would be a tool that you could press a button and it would find out all of the times that the scenes match. Is that what you're sort of getting at?

Jacqueline Stewart: Yes. Does it do it automatically or do you have to know?

Andy Uhrich: At this point I don't think it does. It's not like it's a graphic, a GUI.

Doug Reside: But there is also learning. So you can start to say I'm looking, these are the things that I call people walking up mountain and you don't necessarily specify what that means. You just semantically tag 500, let's say, shots of people walking up mountain. Then the computer starts to try to recognize what visual characteristics of these 500 frames have in common and then a new definition of people walking up mountain is defined in a way that the computer can understand it. Then the 500 and first hopefully matches what the other 500 have.

Andy Uhrich: Sorry. That's a great point. That's the advantage of bringing sort of the film scholars in and the computer scientist in together is to get to that point where the language is being used the same.

Doug Reside: So I totally get the discomfort that that could create. I do think we need to be careful with how we, not as much as how we use it but how we interpret it. I think it's similar to plagiarism tools that are used on journalists or whatever to say you used exactly this phrase. Then we have to decide is that truly plagiarism or is that simply just becoming part of the language or quoting. So when the technology, I guess, goes ahead of the interpretation you need to make sure that we're theorizing that the interpretation of the technology at the same time that we're developing the technology. The technology, I think, is somewhat amoral and that might be used for bad purposes. It's just trying to determine how do we interpret and use those tools.

Andy Uhrich: No, definitely. That's what I think it's important to have the discussion between these different communities.

Shola Lynch: It's also important to say that filmmaker don't think this way. They're not like, okay, in my film in order to convey a certain sense of mountain-ness and people-ness I must have five shots of etc., etc., etc. It's a much more kind of intuitive, this feels right, this is the emotional component I'm trying to convey. So in another way it could be interesting as a filmmaker to have your stuff analyzed.

Jan-Christopher Horak: Its like going to the shrink.

Andy Uhrich: I think they picked this filmmaker because he was sort of the unofficial Godfather of computer technology.

Shola Lynch: This technology will not remain with just this filmmaker and just this.

Andy Uhrich: No, but the question that then arises is do we need different technology for different styles of filmmaking. So if you're looking at amateur home movies is this stuff even valuable. Do we need different kinds of, is that asking for a different kind of tool. So I think there is a way that looking at this specific sort of very metric filmmaker who charted stuff out very precisely leads to these kinds of tools and maybe different kinds of films that are more intuitively edited would require a different sort of technology.

Shola Lynch: And documentaries definitely.

Doug Reside: I do think that that suggests for me to move beyond the kind of consumer approach to technology where the program gave us this data back and so we uncritically accept it or reject it as this is either, you know, it's obviously wrong or it's obviously right but rather become participants in the technology as a sort of scholarly argument where you say this is where that's failing. But I still find this part of it useful. You need to figure out how to interpret those results.

I always think there's a slot that comes up at every digital humanities conference where they show the Google Books thing getting something horribly wrong because of the S's being interpreted as F's or something like that. I think that's only so useful. It helps us, I think, realize that Google Books isn't absolute truth but I think it's also useful to think or it's more useful to think oh well why did they get it wrong and how can we improve its algorithms. What are the right ways of interpreting this data as opposed to just rejecting it because it's scary new digital stuff or fully accepting it because the gods of Google have given it to us so it must be right or whatever.

Andy Uhrich: No, definitely. Something that I found most interesting about this is when they get these results they say why is that. Let's go back to the original print. Let's try to use that sort of confusion that we get when we get these results to reexamine the film, to reexamine the practice.

Are we out of time?

Brian Graney: We are. We have break service set up out there. I think if people want to take a short break now we can begin again at 10:45. I don't want to hold people hostage but if we can just work into the break and take a shorter break that would be great.

Andy Urich: So building off of that Lev Manovich who wrote *The Language of Media*, has a new book called *Software takes Command*. He works at the Software Studies Initiative at the University of California San Diego.

Doug Reside: He just moved.

Andy Urich: He doesn't work where I said he worked.

Matthew Bernstein: Where is he now?

Doug Reside: CUNY, the City University of New York at the graduate center.

Andy Urich: So he has a tool called ImageJ which allows you to look at a whole bunch of images all at once. This is an image pod of a million pages of Japanese comic books and it sort of arranges them by contrast and the amount of information in them. So he applied the scans that were used in the digital formalism project and then found all of these different ways of visualizing similar kind of information. So instead of the Cinematics, the lines in their graph, it's the same thing. This is still a shot log; excuse me, the counting of the length of the shots. It's broken down by reel because in looking back at the average shot lengths of "Man with a Movie Camera" by [Dziga] Vertov they realized that each reel has its own sort of rhythm and arc the larger circle the longer the shot.

Matthew Bernstein: Sorry, the larger the circle...?

Andy Urich: The longer the shot length. So instead of having the longer lines it's just a different way of visualizing the same thing. This is every, this is the second frame from every shot in the film so it allows you to sort of look at the entire film at once building off the concept of distant reading. You could also sort of then go in and then find all the times that the scenes start with the close ups and there's another visualization that shows every shot that starts with a close up. What that tells you is people in Soviet films used to look up towards the bright Communist future, which we knew that from watching the film but you can look at it all.

Allyson Nadia Field: You said the second frame of every shot?

Andy Urich: Yes, because the first frame there might be a fade or a splice or a discoloration from the printing. This then takes the second frame from every shot, which is right up there, and this analyzes the amount of motion in every frame. So the longer the bar there's more motion in each shot.

Shola Lynch: And I will also add that distributors will then start using this software too because what they'll say is in order to have a successful film these films have been successful in the box office so we need these many mountain shots, these many explosions, this many whatever and you'll actually start to have real metrics that you'll have to work to...

Will Cowan: Shots are way too long in this movie.

Shola Lynch: Yes, exactly and we can prove it scientifically because this is what audiences want.

Andy Urich: Which they're doing.

Jacqueline Stewart: But they're doing it anyway, right?

Shola Lynch: Yes, but they'll do it more and more.

Andy Urich: They're doing that with music definitely.

Doug Reside: The thing is I guess I'd rather have people like Lev Manovich doing this than the big data people they hire at Sony or whatever. At least let, I mean it's going to happen. Lev Manovich at least is being somewhat critical about it and I think this community can be even more critical about it. So we can't stop the boulder running towards us but we can think about how to theorize it, I don't know.

Shola Lynch: It's not to stop the boulder. It's absolute you can't but it is to say from this perspective that it gets increasingly more difficult.

Andy Urich: The reason I think it's worth talking about it, if you're not a computer programmer, you can learn the skills and you can do this. You can take control of these tools.

Shola Lynch: And then interpret your own metrics.

Andy Urich: So this is an image plot of every 100th frame from "The Man with the Movie Camera" based on black to white in the terms of the contrast and less visual information.

Allyson Nadia Field: Did Manovich publish this already?

Andy Urich: Yes. I've got the link somewhere.

Allyson Nadia Field: Is that the *Visualizing Vertov*?

Andy Urich: Yes. I can put together a bibliography and send it to Brian and he can send it off.

Allyson Nadia Field: That would be awesome.

Shola Lynch: And the software bibliography too?

Andy Urich: Yes, I can.

Shola Lynch: Just like what software was used.

Andy Uhrich: This was ImageJ.

Will Cowan: He developed the software himself.

Will Cowan: His graduate students did all of the software.

Andy Uhrich: And his name is bigger.

Shola Lynch: And it's available?

Will Cowan: It's open source. I've downloaded most of that stuff and played with it a little bit.

Andy Uhrich: Yes, it's something that I was able to download and play with so that means...

Shola Lynch: I just want to see it.

Andy Uhrich: That gives an overview of the sort of things that people have been looking at in terms of the computer analysis.

Matthew Bernstein: Is it your sense that Apple computers facilitate this more than PC's?

Andy Uhrich: PC's.

Shola Lynch: Really?

Andy Uhrich: Yes. So the Cinemetrics stuff you can't get it to work in Apple very easily.

Shola Lynch: What?

Andy Uhrich: So I think it's more the PC side of things.

Doug Reside: It doesn't really matter.

Doug Reside: Actually I would recommend the Mac because it has Linux on it or it has a Xenix version on it which is where most of the software is being developed. The Cinemetrics is kind of an earlier generation of software studies I feel like. So, yes, most of the new stuff you need a Linux prompt and you can get that on a PC and you can get that on a Mac but it comes kind of nicely packaged on a Mac with a lot of tools. You don't have this dependency there are things that you can type like brew and install or whatever and you get it instantly as opposed to having to hunt around the internet to find it. I guess either way like I said. There are advantages to both platforms.

Matthew Bernstein: So it needs Linux and what else?

Doug Reside: Well, this one I think is a Linux thing, right, the ImageJ?

Andy Uhrich: Yes.

Doug Reside: We're all kind of developing it in whatever languages we like. Any of the open source stuff should work on any platform. You just need to install it right.

Mike Mashon: Several of us were at the Association of Moving Image Archivist conference last week. Brian [Graney], I can't remember if this was your panel but Mark Williams demonstrated this software they're playing around with that can take color files from films and represent it as histograms with color spectrum in film. It was one of those things where it was interesting to see. The takeaway is there seems to be something there, not quite figured out exactly what there there is. It was another tool they could use specifically for color.

Doug Reside: You can see when Harry Potter films get darker and darker.

Andy Uhrich: That's called ACTION and it's an acronym for something about movies and technology and that's through Dartmouth. It's a different thing than media ecology.

Mike Mashon: It's different from media ecology.

Will Cowan: A funny thing I saw on the web the other day is animated GIF's of entire movies. All of a sudden I've seen those popping up everywhere. Software where you actually can have an animated GIF that lasts a couple of minutes that shows an entire hour and a half, two-hour movie. It just zips through the scenes very quickly. It's similar to that. It's like every 100th frame or something. It's a fun thing that technologists do who have nothing, who go I wonder how far I can stretch this GIF? Can I get an entire movie in it? Oh, I can.

Terri Francis: It's like Hamlet and whatever it is. It's not completely foreign. I seem to recall doing some Scan-tron as an English major 20 years ago.

Jacqueline Stewart: In literary studies we've been doing this forever.

Shola Lynch: But I keep thinking of Felonious Munk. So he was brilliant and when he read reviews and he started to think about this kind of information he stopped playing for a couple of years. Information is so important at the same time we don't want it to be debilitating.

Andy Uhrich: I think it's the motive to dissect thing...

Allyson Nadia Field: Would it be helpful though for you to, if you mapped out, if you did this for your own films and then you see patterns, this intuitiveness becomes then compromised in a way?

Shola Lynch: That's another conversation.

Jan-Christopher Horak: Don't do it.

Doug Reside: Yes, that's our job. You make it and we'll run it through.

Terri Francis: But I can't see what's his name at the time, I mean those reviews are so, they're not analytical.

Shola Lynch: Perhaps this is a bad analogy but it's the same kind of thing where how much information is too much information because there is part of creating art that isn't always about metrics. So the more you're asked to provide metrics and I think about from being viable like if you're trying to make films and you have to work with studios and they're like, okay, these are your metrics. You know what I mean? If you're an independent filmmaker and you're just doing it on your own and you don't have to think about these things well then that's fine. You can do it afterwards. Afterwards it's kind of cool to say, okay, well what happened. It will impact and you can't stop it. This is just my initial and emotional nonanalytical response.

Andy Uhrich: It's great to hear because I think when we're talking about using these sort of tools for reconstruction films from the archival world it's important to be aware of that viewpoint.

Shola Lynch: And also as historians so the piece I did on Angela Davis, I had a long conversation with Kathy Cleaver and she goes, Shola, you're trying to go back and reconstruct these certain moments and understand them but have you considered that not everything makes sense. Do you know what I mean? That was so profound for me because I kept wanting to like make sense but sometimes it doesn't.

Andy Uhrich: Well, I think some of these tools they look like they make sense but there's still a place for abstraction, there's still a place for things not exactly matching up. It looks like it's metrics but I think there's still room for play and for improvisation and looking at these things. Like I said, when we looked at all the 10,000 films from Cinemetrics it looked like, I mean it had these references to other visual characteristics.

Jan-Christopher Horak: Look at this image we're looking at. Please tell me what kind of analytic theories you can develop from that salad. Really. Yes, I can see that it's darker on one side and lighter on the other but then you get into this middle section and then it's like just mush.

Andy Uhrich: I would think that...

Matthew Bernstein: You can frame it and hang it on the wall.

Jan-Christopher Horak: Yes, it's abstract art. I can see other uses for it.

Andy Uhrich: And that's a valid use. I think there's also I think you're talking about looking at all of the Harry Potter movies over time. So if you're going to be using this as a comparative tool, comparing tools over time for different national cinemas then you might be able to get some sort of broad analytical views.

Doug Reside: And it's very early in this kind of approach too. We're decades into this kind of, or maybe a decade into this software studies approach. Whereas there has been arguably 2,000 years of literary critical history. So it does, I think, it's more kind of experimentation and play and kind of seeing what do we discover right now in these sorts of tools. Then there's the kind of criticism of the mapping of all the places in "War and Peace" that we learned in "War and Peace" and about Russia. So we knew that. But there's that sort of first step then maybe provokes other questions that you might ask that are more useful.

Brian Graney: Thanks, Andy [Uhrich].